

thin layer of the jelly-like mesoderm. The ectodermic covering consists, except over the free end where the cells are simple and flattened, of long columnar, ciliated cells, the fixed ends branching into delicate fibres, which form a stratum underneath the epithelium. A similar condition of the ectoderm is described as met with in two depressions of the surface, one being situate above, and the other below, the lithocyst; and the resemblance which the elongated epithelium cells with the subjacent granular-looking, but in reality fibrous stratum, exhibits to the developing central nervous structures in the vertebrate embryo is pointed out. These parts, in fact, probably represent the first beginnings—phylogenetically—of a central nervous system. Some of the cells of the ectodermic covering of the lithocyst are pigmented, and these cells are provided each with an excessively long and fine (sensorial) filament instead of with vibratile cilia.

The endodermic core of the lithocyst consists of a prolongation from the nutritive canal of the margin, which at the terminal part of the lithocyst is continued as a solid projection, the cells of which contain calcareous crystals or otoliths.

A small lithocyst is further described, in which the otolithic prolongation of the nutritive canal penetrated the ectodermic covering, and projected freely into the surrounding medium.

Reference is made to the observations of Haeckel upon the nervous system of *Geryonia* and *Cunina*, and to a recently published preliminary notice by Oscar and Richard Hertwig, of the structure of the nerve-tracts and sense-organs in various other genera of *Medusæ*.

January 17, 1878.

Sir JOSEPH HOOKER, K.C.S.I., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

- I. "On Cobra Poison." By ALEXANDER PEDLER, F.C.S., Professor of Chemistry in the Presidency College, Calcutta. Communicated by Dr. FRANKLAND, F.R.S., Professor of Chemistry in the Royal School of Mines. Received November 1, 1877.

On my arrival in India my attention was strongly directed to the enormous number of deaths, annually resulting from the bites of poisonous snakes. Statistics of the deaths from such causes are

collected by the various Provincial Governments of India, but as might be expected the difficulty of obtaining correct returns is very great, and it is certain that the number registered is far short of the real mortality resulting from this cause. Even with such incorrect returns, however, as many as 11,416 deaths in India from the bites of poisonous snakes were reported during a single year,* and it is probably within the mark to say that in the whole of India the annual number of deaths from snake bite is not less than 15,000.

Experiments without number have been made with a view to discover an antidote for snake virus; but although many so-called remedies have been reported, it has been found on closer examination, that none of them have been of the slightest efficacy either in modifying the action of the poison, or in any way tending to save life. The nearest approach to success among these unsuccessful remedies appears to have been the system of artificial respiration, suggested by Sir J. Fayrer, and extensively experimented with by the Snake Poison Commission at Calcutta, whose report was published in 1874,† and who found that, although life might be prolonged by the use of artificial respiration after poisoning by snake virus, in no case was there any ultimate hope of saving life by this means.

So far as I am acquainted with their results, the researches of other chemists have been hitherto unsuccessful either in elucidating the nature of the poison, or in ascribing any composition to the active principle which must be present. This want of success is the only justification of my bringing the result of my own researches before the Royal Society at all; while the great practical importance of a satisfactory solution of the problem will, I hope, be accepted as my apology for laying my work before them in its present incomplete form.

Of all the snakes in India the cobra (*Naja tripudians*) is the cause of the largest number of deaths, and the experiments here described were all made with cobra poison, extracted from the snakes in my own presence, by the usual method as described in published memoirs on the subject of snake poisoning. As may be imagined, the supply of cobra poison which is obtainable is very small, each snake yielding only from one to three grains of solid poison; so that, in all my experiments, I have been continually hampered with the extreme difficulty of procuring a sufficient amount of the poison to work with on a satisfactory scale. In submitting my results to the Society, I must at the outset state that it is possible that after further experiments I may have to modify some of the results here given.

The liquid poison, which, when extracted from the cobra, has a slightly alkaline reaction, was found to have a specific gravity of 1.095

* 1869. See Fayrer, Proc. Roy. Soc., xxi, p. 360.

† Report on Indian and Australian Snake Poisoning. Bengal Secretariat Press, Calcutta.

at 23° C., the experiment being made on the average poison collected from 16 snakes on November 26th, 1874. Whether evaporated in dry air, or in *vacuo*, or at 100° C., the fresh poison gave nearly the same amount of solid residue, the mean quantity being 28·28 per cent., the poison extracted from one batch of snakes in the rainy season (July) giving 27·74 per cent., and the poison from 16 snakes on November 24th, after the cessation of the rains, giving 28·82 per cent.

As these samples were taken the first during the hot and moist rainy season, when these snakes are most active, and yield the largest quantity of poison, and the second during the cold season, when they are very sluggish, and yield only small quantities of virus, it may be hypothesised that throughout the year there is very little change in the actual amount of solid present in the liquid poison shed by the cobra.

I have tested the fresh liquid poison with polarized light, but found that it was optically inactive.

With reference to the action of time on cobra virus, my own conclusions do not altogether agree with results previously obtained; thus, in the report of the Snake Commission above referred to, it is stated that the poison undergoes no change by being kept; but, from my experience, I have found, that although the poison will not alter if kept for two or three months only, yet if it be kept for a year or eighteen months, it alters in its properties very materially, becoming insoluble, and indeed losing to a considerable extent its poisonous action. In fact, I gradually collected a considerable quantity of the poison, with a view to experiment on a larger scale; but, on commencing work, I found the poison almost inert, and perfectly valueless for any scientific investigation on the subject, and in this way lost much time, and a very considerable amount of material extremely difficult to procure or replace.

The poison dried *in vacuo* over sulphuric acid was analysed, and the mean result was found to be:—

Carbon	49·32 per cent.
Hydrogen	7·01 ,,
Nitrogen.....	17·39 ,,
Ash.....	6·68 ,,
Oxygen and sulphur by difference	19·60 ,,
	100·00

If we regard the ash as being foreign to the organic poison, the proportion of the other elements will then become*—

* A part of these results was submitted by me to the Snake Poison Commission, and published by them at page 42 of their report.

Carbon	52·87
Hydrogen	7·51
Nitrogen.....	18·29
Oxygen and sulphur.....	21·33
	100·00

The composition of crude cobra poison then approaches rather closely to the known composition of the various kinds of albumin, but the amount of nitrogen in the virus is rather in excess of that contained in egg albumin.

On testing the cobra poison qualitatively, I found that it contained a considerable proportion of a substance which gave all the tests of ordinary animal albumin,* and the amount of this substance was estimated by precipitation with strong alcohol, 0·5403 gram of fresh cobra virus treated in this way gave ·0935 gram dry albumin, and ·0584 gram of a substance, which was gummy and amorphous in appearance. The albumin on testing was found to be slightly poisonous, and from its physiological action I concluded that it could not contain more than from one-fiftieth to one-hundredth part its weight of the poisonous principle. The portion soluble in alcohol was *excessively* poisonous. It appears, then, that in the poison obtained from the cobra there is about 17·3 per cent. of albuminous matter, and 10·9 per cent. of poisonous matter only, or that about 60 per cent. of the solid cobra poison is of an albuminous nature, and only 40 per cent. at the most is pure poison. I have endeavoured, by the use of solvents, both chemical and mechanical, to separate out some crystallizable principle from the poison; but although I have used a great variety of liquids, I have not yet succeeded in obtaining anything but indications of crystallizable matter, and I have now given up all hope of separating any distinct principle from the poison by this method. Dialysis through parchment paper was tried, in the hope of separating some principle, and about half a gram of the solid poison, dissolved in water, was allowed to dialyse for five days; at the end of that time the liquid from the interior of the dialyser, when evaporated, gave an amorphous gummy mass, which had all the physiological properties of cobra poison; the liquid, outside the dialyser, when evaporated, gave a residue the greatest part of which was like gum, but a few apparent crystals could be detected. This was tested physiologically, and was, if anything, rather more poisonous than the ordinary virus, and I was,

* Dr. Armstrong (Proc. Roy. Soc., xxi, 363) had already noticed that the liquid poison when kept contains albuminous matter, but the poison that he examined had already begun to undergo decomposition. The chemical composition of the poison, as determined by Dr. Armstrong, shows a much smaller proportion of carbon and nitrogen than that found by me in the fresh poison. As I have mentioned, the poison does not keep well either as a liquid or a solid, hence the disagreement of the results.

therefore, unable to obtain any satisfactory result by the aid of dialysis.

I have satisfied myself by numerous experiments that the reported remedy for snake bite, ammonia, has no action chemically upon the poison, but that, if anything, the addition of this substance to the poison before hypodermic injection rather increases the rapidity of the action of the poison, and in no instance does it induce any modification of the poisonous action.

Whilst experimenting with the poison, it struck me that it was possible that, as in the case of many organic poisons, the nitrogen might be in the triad condition, and that it might be possible to modify the poison by the action of ethylic iodide or other substances, as has been done in the case of some alkaloids. Ethylic iodide was digested with the poison, and the residue, which had increased in weight, when physiologically tested, was found to be very much less active than usual, although still poisonous; the sample taking about five times as long to kill as fresh cobra poison. Another sample of poison was treated with hydrochloric acid, and evaporated spontaneously, and the residue was very much less active than ordinary poison, and I have found that even the addition of a small quantity of this acid to a solution of the poison before injection materially retards the poisonous action; for a quantity (3 milligrams) of poison, which under ordinary circumstances would kill a chicken in about half-an-hour or forty minutes, after the addition of 0.2 c.c. of hydrochloric acid took 1 hour 6 minutes to produce the same effect. The poison treated with hydrochloric acid, when evaporated very slowly *in vacuo*, shows distinct traces of crystals; but there still remains a large quantity of amorphous soluble matter, from which, when working on a small scale, as from the nature of the subject I was obliged to do, the crystals cannot be separated.

As hydrochloric acid has some apparent chemical action on cobra poison, I tried the effect of a number of chemical compounds on this substance, and by a natural sequence of ideas, having found that hydrochloric acid had a tendency to act in the required direction, amongst them I employed platinum tetrachloride, and found that this yielded excellent results, and gave indications of what might be called a chemical antidote.

The following is a typical experiment. A quantity of fresh cobra poison was precipitated with alcohol, and the precipitate of albuminous matter well washed, then dissolved and tested, and found to have very slight poisonous action only, the alcoholic filtrate was then acidified with hydrochloric acid, and a solution of platinum tetrachloride added, when a small quantity of a yellow amorphous precipitate was formed; the solution on evaporation *in vacuo* yielded a semi-crystalline residue, from which the excess of the platinum salt was removed by washing with dilute alcohol; 0.1 gram of the solid platinum compound, which

appeared to be very insoluble in water, was administered internally to a chicken, and had no poisonous action; and the solution containing the excess of platinum salt when injected into a chicken had no action whatever.

Here, then, was a case in which, apparently, the poisonous action of the virus had been destroyed or neutralized, for the albuminous precipitate certainly did not contain more than from one-fiftieth to one-hundredth part of its weight of poisonous material.

I have endeavoured to obtain a sufficient quantity of the poison to give me enough of the platinum compound for the determination of its composition, but up to the present time I have only succeeded in making one complete analysis; the numbers which I have obtained are as follows:—

·2583 gram of platinum compound yielded ·3065 gram CO_2 , ·0996 gram H_2O and ·0418 gram platinum. From this it follows that $\text{C} = 33\cdot42$ per cent., $\text{H} = 4\cdot28$ per cent., $\text{Pt.} = 16\cdot18$ per cent. Also ·0946 gram platinum compound yielded ·1462 gram ammonia platinum chloride, therefore, $\text{N} = 9\cdot69$ per cent. Unfortunately, I have been unable to determine the amount of chlorine, but if the compound has the ordinary composition of Cl_6 for Pt. , the amount of chlorine present would be $17\cdot42$ per cent., and we should thus get:—

By Experiment.	Calculated for formula PtCl_4 ($\text{C}_{17}\text{H}_{25}\text{N}_4\text{O}_7\text{HCl}$) ₂
Platinum 16·18 per cent.	16·36 per cent.
Chlorine by calculation.. 17·42 "	17·65 "
Carbon 33·42 "	33·81 "
Hydrogen 4·28 "	4·31 "
Nitrogen 9·69 "	9·29 "
*Oxygen by difference 19·01 "	18·58 "

Judging from such insufficient data, it would be impossible to assign with certainty any formula to this compound. It will be seen that I have appended the percentage composition calculated for PtCl_4 ($\text{C}_{17}\text{H}_{25}\text{N}_4\text{O}_7\text{HCl}$)₂; but, of course, I do not imagine that I have ascertained the true formula of the poisonous principle; I merely throw it out as a suggestion that its composition may be something near $\text{C}_{17}\text{H}_{25}\text{N}_4\text{O}_7$, or the double of this.

From the experiment described above, it will be seen that the addition of the solution of platinum tetrachloride caused a marked change in the physiological action of the poison; and it should be borne in mind, that my main object in these experiments was the discovery of

* Only the faintest traces of sulphur are present in the compound.

an antidote (if possible) rather than the solution of the purely chemical question.

The experiments which I have made to investigate the physiological portion of the subject, naturally divide themselves into three distinct series: the first, in testing the action of graduated doses of the pure fresh poison hypodermically injected into animals; the second, in the injection of cobra virus mixed with dilute aqueous solution of platinum tetrachloride; and the third, in the action of the platinum salt on animals previously poisoned by fatal doses of the virus.

In my preliminary experiments, I assured myself that fresh cobra poison mixed directly with a small quantity of solution of platinum tetrachloride almost entirely loses its poisonous properties. In order to investigate this thoroughly, I selected chickens as good subjects to work on, and first ascertained the action of pure fresh cobra poison in various quantities, hypodermically injected, on these animals. The summary of the results which I obtained are shown in Table A, whilst the details of the experiment are described in an Appendix* which contains the description of most of the more important physiological experiments made during this investigation.

TABLE A.—*Action of Cobra Poison, hypodermically injected, on Chickens.*

No.	Amount of Dried Poison used.	Duration of Experiment.		Result.
		Hours.	Minutes.	
1	6 milligrams	..	17	Death
2	5 "	..	31	"
3	1 milligram	..	38	"
4	$\frac{1}{2}$ "	1	12	"
5	$\frac{1}{4}$ "	1	34	"
6	$\frac{1}{10}$ "	2	40	"
7	$\frac{1}{15}$ "	1	52	"
8	$\frac{1}{20}$ "	The animal was almost insensible for 12 hours.		Recovered

From this table, it appears that a quantity of $\frac{1}{15}$ milligram of pure dry cobra poison is sufficient to kill with certainty a healthy chicken, while $\frac{1}{20}$ of a milligram, when injected, produced such an effect, that for twelve hours the life of the chicken was despaired of; in larger doses the action of the poison is proportionately more rapid, until with a few milligrams death results within a few minutes.

A second series of experiments was then tried, by taking solutions of weighed quantities of the same sample of cobra poison as was used in the first series, mixing with known weights of platinum tetrachloride, and injecting. The experiments are subdivided into two classes, according to slight variations in the method of working; in some

* This Appendix is deposited in the Archives of the Royal Society.

cases the mixture of the poison and platinum salt was allowed to stand for a short time previous to the injection; and, in the remainder, the injection was performed a few seconds after the platinum solution had been added to the poison. The results are shown in Table B, which is divided into two sections: the first, showing experiments with the injection performed a short time after the mixture was made; and the second section showing injections made immediately after the two substances had been brought into contact with each other.

TABLE B.—*Action of Cobra Poison mixed with Platinum Tetrachloride on Chickens.*

I.—Injection performed a short time after Mixing.

No.	Weight of Dried Cobra Poison.	Weight of PtCl_4 .	Duration or Symptoms.	Result.	No. of Chickens which the Poison if used alone was capable of killing.
1	3 milligrams	·01 gram	No symptoms of cobra poisoning	Survives	45 chickens
2	6 "	·02 "	"	"	90 "
3	6 "	·02 "	"	"	90 "
4	8 "	·025 "	"	"	120 "
			hours. min.		
5	10 "	·03 "	15 0	Death	150 "
6	15 "	·05 "	50 6	"	225 "

II.—Injection performed at the instant of Mixing.

			hours. mins.		
7	9 milligrams	·025 gram	4 0	Death	135 chickens
8	12 "	·04 "	1 25	"	180 "
9	12 "	·025 "	4 10	"	180 "

The first section of this table shows that almost any quantity, however large, of cobra poison mixed with the platinum salt, may be injected into chickens without producing any poisonous action; in the fourth experiment, for instance, enough poison to kill 120 chickens was injected into one chicken, and although the animal became drowsy and was evidently much upset by the injection of a large volume of liquid, the symptoms which were developed were not those of cobra poison, and the animal in the course of a day or two recovered its usual health and strength. In the case of No. 5, Table B, enough poison to kill 150 chickens was injected, and death resulted in fifteen hours; but the death apparently resulted from the effect of the shock to the system of the chicken, caused by the injection of such a large volume of liquid as was necessary. The same remark also applies to

Experiment 6, where enough poison to kill 225 chickens was injected, and death resulted from the setting in of diarrhœa, and from the subsequent exhaustion, in 50 hours 6 minutes after the performance of the hypodermic injection. In the experiments of injecting the mixture of the cobra poison and solution of platinum tetrachloride immediately after it was made, the results are not quite so satisfactory, but they still show that large quantities of poison (enough to kill 180 chickens being used in Experiment No. 1) may be injected, and that the fatal result does not take place until after the expiration of a period very much longer, as a rule, than would be the case without the use of the platinum salt. I have not thought it worth while to experiment with small quantities of poison in this manner, as the result of the first section conclusively shows that, if the platinum salt has time allowed to act upon the poison, the poisonous action of the virus is entirely destroyed. Before finally accepting this conclusion, I thought it advisable to try a similar set of experiments on other animals, such as dogs; and, as will be seen below, the experiments which have been performed have entirely borne out the conclusion above arrived at.

In the report of the Snake Poison Commission already referred to, a number of experiments have been made on the action upon dogs of graduated doses of cobra virus, and in the following table will be found a summary of the principal results:—

TABLE C.—*Action of Cobra Poison on Dogs.*

	Wt. of Poison injected.	Weight of Dog.	Time of Experiment.	Result.
			hrs. mins.	
*I.S.P.C. 3.	2½ grains	33 lbs.	1 43	Death
I.S.P.C. 4.	2 "	25 "	1 43	"
I.S.P.C. 5.	1½ "	39 "	1 21	"
I.S.P.C. 6.	1 grain	28 "	1 42	"
I.S.P.C. 7.	1 "	24 "	0 57	"
I.S.P.C. 8.	$\frac{3}{4}$ "	35 "	1 32	"
I.S.P.C. 9.	$\frac{1}{2}$ "	24 "	2 24	"
I.S.P.C. 10.	$\frac{1}{2}$ "	19 "	1 58	"
I.S.P.C. 11.	$\frac{1}{4}$ "	20 "	4 20	"
I.S.P.C. 12.	$\frac{1}{4}$ "	41 "	8 0	"
I.S.P.C. 16.	$\frac{1}{6}$ "	40 "	5 6	"
I.S.P.C. 17.	$\frac{1}{8}$ "	14 "	4 28	"
I.S.P.C. 14.	$\frac{1}{10}$ "	18 "	11 30	"

From this table it appears that from a quarter of a grain (.0162 gram) to a sixth of a grain may be looked on as a fatal dose to an ordinary sized dog, while any quantities larger than this will produce a very rapidly fatal effect.

In order to test the action of the poison mixed with platinum salt,

* These refer to the number of each experiment in the report above quoted.

as before, I used weighed quantities of the dried fresh poison dissolved in water, and added known quantities of a standard solution of platinum tetrachloride; the results of these injections into dogs are shown in the table below, and in no instance did they show the slightest indication of any physiological action whatever. These animals were still alive when this paper was written.

TABLE D.—*Injection of Mixture of Cobra Poison and PtCl₄ into Dogs.*

No. of Expt.	Weight of Dog.	Weight of Cobra Poison used.	Weight of PtCl ₄ used.	Duration of Expt.	Result.
1	38 lbs.	$\frac{1}{2}$ grain = '0324 gram	'065 gram	..	Not affected
2	25 "	1 grain = '0648 gram	'13 gram	..	"
3	35 "	3 grains = '1944 gram	'30 gram	..	"

If we accept the conclusion that $\frac{1}{2}$ grain of cobra poison hypodermically injected will kill a dog under ordinary circumstances, in the three experiments under notice the quantities of cobra poison used were sufficient to kill three, six, and eighteen dogs respectively; and yet in no case did the dog show the slightest indication of cobra poisoning. I have not tried larger quantities than three grains of poison, as the volume of liquid which has then to be injected becomes inconveniently large; even in Experiment No. 3 in Table D no less than four or five separate hypodermic injections had to be made, to the great inconvenience of the dog experimented upon. From these results I think it may safely be said, that the compound which cobra poison produces when brought into contact with an aqueous and dilute (5 per cent.) solution of platinum tetrachloride is quite inert and physiologically inactive, though of course it does not follow that this substance can be used as an antidote in cases of snake poisoning. If I may be allowed the expression, platinum tetrachloride appears to be a chemical antidote to cobra virus, but whether it will be found to be a physiological antidote can only be settled by extensive researches.

Next, then, with a view to ascertain tentatively whether platinum tetrachloride can be used as an antidote, in the ordinary sense of the word, to snake poisoning, I have tried two sets of experiments described below. The results which I have obtained from this third series of experiments, although interesting and to a certain extent hopeful in their nature, have not, I am sorry to say, in any case shown that life can be saved by this means. As a preliminary step in the elucidation of this very important question, I have made some experiments on fowls and dogs by first hypodermically injecting known quantities of poison more than sufficient to kill, and after a definite interval injecting known quantities of the standard solution of platinum tetrachloride, at or near the same spot where the first injection was per-

formed. By the experiments of other investigators on the subject of snake poisoning, it has been found that the rapidity of the absorption of cobra poison is quite marvellous, and from the beginning I clearly saw that this would be the cause from which in all probability all experiments for the discovery of a true antidote would fail. So far as I could ascertain the non-success of the experiments about to be described appeared to be due to this cause; I first experimented upon chickens in the manner described above, and found that in two cases out of three life was prolonged to a very considerable extent, but I did not succeed in preventing death.

The results are given in Table E.

TABLE E.—*Experiments on Chickens.*
Injection of Platinum Salt after Poisoning by Cobra Virus.

No. of Experiment.	Amount of Cobra Poison.	Interval before Injection of PtCl_4 .	Amount of PtCl_4 .	Duration of Experiment.	Result.
1	$\frac{1}{2}$ milligram	5 minutes	·025 gram	hrs. min. 2 2	Death
2	$\frac{1}{10}$ „	1 minute	·05 „	1 5	„
3	$\frac{1}{4}$ „	1 „	·015 „	11 47	„

In Experiment No. 1 the amount of poison injected (enough to kill seven fowls) would, under ordinary circumstances, kill in about an hour or an hour and a quarter, but the animal here lived more than two hours. In Experiment No. 2 the poison would, under ordinary circumstances, kill in about an hour and a half, but in the experiment in question it killed in one hour and five minutes. This showed me a defect in my mode of working, in fact by injecting the platinum solution into the same orifice as the poison, and to about the same depth beneath the skin, I had merely driven the poison along before the second solution, and thus diffused it more rapidly through the system, naturally causing death to result in a shorter time than would have otherwise been the case. I should here mention that the same remark applies to some of the experiments I made on dogs described in the next table. In Experiment No. 3 in Table E, the amount of poison injected into the chicken was enough to kill three or four chickens, and would under ordinary circumstances have killed in from an hour and a half to one hour and forty minutes. In this case to avoid the defect in Experiment No. 2, the platinum solution was injected rather deeper than the poison, and the result was that the animal lived for eleven hours forty-seven minutes, or more than seven times as long as would have been the case had no platinum salt been injected. This was of course encouraging, and seemed to promise that the platinum salt would in certain circumstances be useful. The experiments made on dogs are

summarized in Table F, and the method used was the same as before described.

TABLE F.—*Injection of Platinum Tetrachloride into Poisoned Dogs.*

No. of Expt.	Wt. of Dog in lbs.	Amount of Cobra Poison used.	Interval before use of PtCl_4 .	Amount of PtCl_4 injected.	Duration.	Result.
1	31	$\frac{1}{2}$ grain = '0324 gram	1 to 2 min	'05 gram	hr. min. 2 45	Death
2	15	$\frac{1}{4}$ grain = '0162 gram	1 minute	'05 "	1 48	"
3	40	$\frac{1}{4}$ grain	1 minute	'10 "	5 20	"
4	42	$\frac{1}{4}$ grain	3 minutes	'15 " internally	4 20	"

The platinum salt does not in these instances appear to have been as efficacious as in the experiments on chickens, and as previously mentioned I believe that the want of success was owing to the rapidity with which the poison is absorbed and diffused through the system, preventing any chance of the platinum salt coming in contact with the virus. This must prove a serious obstacle to the efficacy of any remedy. I confess that from my own experience of the rapidity of the absorption of this poison, I have considerable doubt as to the possibility of an antidote to snake poison ever being discovered, for in a few seconds after the actual bite of a snake the poison is absorbed by the blood, and carried by it to all parts of the system, and thus the task of overcoming or neutralizing the virus is rendered extremely difficult if not practically impossible.

In making the experiments described in the last two tables, I have been seriously hampered with the want of knowledge as to the physiological action of platinum salts in general, and of the platinum tetrachloride in particular; and although I have searched through every available authority, I have been unable to find any results bearing however slightly on this subject. To work out the problem before us, we must begin with selecting suitable living subjects for experiment. We must then ascertain what is the physiological action upon these animals of the platinum salt and of the cobra poison separately, both when administered internally and when injected hypodermically. Having settled these preliminary questions, we must proceed to test the applicability of the platinum salt as an antidote to the cobra virus by injecting hypodermically into similar subjects the smallest dose, which our preliminary experiments have shown to be fatal, and subsequently administering the platinum salt in various ways.

As my own physiological knowledge and surgical skill are very slight, I have asked Dr. E. Lawrie to join in the investigation above sketched out, and we have already commenced our experiments, the

results of which we hope to submit to the Society in a subsequent communication.

I do not, of course, lay any claim to have discovered an antidote (in the true sense of the word) to cobra poison, but I think that the experiments above described prove the inertness of the platinum compound of cobra virus, and that this may be deemed a sufficient ground for making more extensive researches on this subject. Nor do I at present venture to make any practical suggestions in connexion with the above facts as to the treatment of cases of snake bite, for until we are acquainted with the physiological action of platinum compounds this would be premature. The responsibility of recommending any change in the recognized methods of treatment would be very great, and it would be worse than rashness to deal with a subject of such vital importance without having a thorough knowledge of the effects likely to be produced by our actions.

Before concluding my paper I must tender my thanks to Mr. R. H. Wilson, C.S., officiating magistrate of the 24 Pergunnas, for kindly assisting me in procuring live cobras for the extraction of the poison, and to my assistant, Balm Poolin Behary Saor, for much aid rendered during the progress of a work not always pleasant to the feelings, and always more or less dangerous in its nature.

II. "On Repulsion resulting from Radiation. Part V." By
WILLIAM CROOKES, F.R.S., V.P.C.S. Received December 3,
1877.

(Abstract.)

This paper commences with an experimental investigation of the amount of repulsion produced by radiation on disks of various kinds, and coated with different substances. The torsion apparatus for this purpose consists of a straw beam, suspended by a fine glass torsion fibre. At one end of the beam is a rod hanging downwards, and capable of taking six experimental disks in a vertical row. The other end of the beam is furnished with a pan and adjustable weights, to balance the varying weights of the disks submitted to radiation. A standard candle, at a fixed distance from the disks, supplies the radiation, and the amount of movement under its influence is measured by a ray of light reflected from a mirror on the beam to a graduated scale. An appropriate arrangement of screens enables any selected disk to be experimented on without the others being affected, and a standard lampblack disk being always present, the results are capable of intercomparison. The beam, torsion fibre, disks &c., are sealed up in glass, and the whole apparatus is attached to a mercury pump, capable of carrying the exhaustion to any desired point.